

**JUNE 1999**

## **PROVINCIAL EXAMINATION**

**MINISTRY OF EDUCATION**

# **APPLICATIONS OF MATHEMATICS 12**

### **GENERAL INSTRUCTIONS**

1. Insert the stickers with your Student I.D. Number (PEN) in the allotted spaces above and on the **back** cover of this booklet. **Under no circumstance is your name or identification, other than your Student I.D. Number, to appear on this booklet.**
2. Ensure that in addition to this examination booklet, you have an **Examination Response Form**. Follow the directions on the front of the Response Form.
3. **Disqualification** from the examination will result if you bring books, paper, notes or unauthorized electronic devices into the examination room.
4. All multiple-choice answers must be entered on the Response Form using an **HB pencil**. Multiple-choice answers entered in this examination booklet will **not** be marked.
5. For each of the written-response questions, write your answer in the space provided in this booklet.
6. When instructed to open this booklet, **check the numbering of the pages** to ensure that they are numbered in sequence from page one to the last page, which is identified by

**END OF EXAMINATION**.

7. At the end of the examination, place your Response Form inside the front cover of this booklet and return the booklet and your Response Form to the supervisor.

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## APPLICATIONS OF MATHEMATICS 12 PROVINCIAL EXAMINATION

	Value	Suggested Time
1. This examination consists of <b>two</b> parts:		
PART A: 45 multiple-choice questions	45	75
PART B: 8 written-response questions	25	45
	<b>Total: 70 marks</b>	<b>120 minutes</b>

- Aside from an approved calculator, electronic devices including dictionaries and pagers are **not** permitted in the examination room.
- The last **three** pages inside the back cover contain **Formulae, Table of Z-scores, Rough Work for Graphing, and Rough Work for Multiple-Choice**. These pages may be detached for convenient reference prior to writing this examination.
- You will not be provided with any additional paper since rough-work space for the written-response questions has been incorporated into the space allowed for answering each question. You may not need all of the space provided to answer each question.
- A graphing calculator is essential for the Applications of Mathematics 12 Provincial Examination.** The calculator must be a hand-held device designed primarily for mathematical computations involving logarithmic and trigonometric functions as well as for graphing functions. Computers, calculators with a QWERTY keyboard, and electronic writing pads will not be allowed. Students must not bring any external devices to support calculators such as manuals, printed or electronic cards, printers, memory expansion chips or cards, or external keyboards. Students may have more than one calculator available during the examination, of which one may be a scientific calculator. Calculators may not be shared and must not have the ability to either transmit or receive electronic signals. In addition to an approved calculator, students will be allowed to use rulers, compasses, and protractors during the examination.
- If, in a justification, you refer to information produced by the calculator, this information must be presented clearly in the response. For example, if a graph is used in the solution of the problem, it is important to sketch the graph, showing its general shape and indicating the appropriate window dimensions.
- When using the calculator, you should provide a decimal answer that is correct to **at least two decimal places** (unless otherwise indicated). Such rounding should occur **only** in the final step of the solution.
- This examination is designed to be completed in **two hours**. Students may, however, take up to **20 minutes** of additional time to finish.

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**PART A: MULTIPLE CHOICE**

**Value: 45 marks**

**Suggested Time: 75 minutes**

**INSTRUCTIONS:** For each question, select the **best** answer and record your choice on the Response Form provided. Using an HB pencil, completely fill in the circle that has the letter corresponding to your answer.

1. Determine the element in the 3<sup>rd</sup> row and 2<sup>nd</sup> column of matrix  $A$ .

$$A = \begin{bmatrix} 2 & 1 & 4 \\ 3 & -2 & 0 \\ 0 & 3 & 2 \end{bmatrix}$$

- A. -2
- B. 0
- C. 2
- D. 3

2. Determine the following matrix product:

$$\begin{bmatrix} 1 & 0 \\ 0 & 1 \end{bmatrix} \begin{bmatrix} 2 & -3 \\ 5 & 7 \end{bmatrix}$$

- A.  $\begin{bmatrix} 2 & 0 \\ 0 & 7 \end{bmatrix}$
- B.  $\begin{bmatrix} 2 & 5 \\ -3 & 7 \end{bmatrix}$
- C.  $\begin{bmatrix} 2 & -3 \\ 5 & 7 \end{bmatrix}$
- D.  $\begin{bmatrix} 0 & -3 \\ 5 & 0 \end{bmatrix}$

3. Find the value of  $y$  if:

$$\begin{bmatrix} -4 & 2 \\ 5 & 3x-2 \end{bmatrix} = \begin{bmatrix} 8-3y & 2 \\ 5 & -5 \end{bmatrix}$$

- A.  $-4$
- B.  $-\frac{4}{3}$
- C.  $\frac{4}{3}$
- D.  $4$

4. If matrix  $A$  has dimension  $2 \times 3$ , what is the dimension of matrix  $B$  such that **both**  $AB$  and  $BA$  are possible?

- A.  $2 \times 2$
- B.  $2 \times 3$
- C.  $3 \times 3$
- D.  $3 \times 2$

5. Logging trucks A, B and C have two-way radios. Only A's radio is working properly. Truck B can only send messages and truck C can only receive messages. Which matrix describes the communication network?

A.

		To		
		A	B	C
From	A	0	0	1
	B	1	0	1
	C	0	0	0

B.

		To		
		A	B	C
From	A	0	1	1
	B	0	0	0
	C	1	0	1

C.

		To		
		A	B	C
From	A	0	1	0
	B	1	0	1
	C	1	0	0

D.

		To		
		A	B	C
From	A	0	1	1
	B	1	0	1
	C	0	0	0

6. Find  $(2A)^2$  if  $A = \begin{bmatrix} 1 & -1 \\ 2 & 1 \end{bmatrix}$ .

A.  $\begin{bmatrix} -1 & -2 \\ 4 & -1 \end{bmatrix}$

B.  $\begin{bmatrix} -2 & -4 \\ 8 & -2 \end{bmatrix}$

C.  $\begin{bmatrix} -4 & -8 \\ 16 & -4 \end{bmatrix}$

D.  $\begin{bmatrix} 4 & 4 \\ 16 & 4 \end{bmatrix}$

7. In a certain town, if it rains one day, the chance that it will rain the next day is 35%. However, if it does not rain, the chance for rain the next day is only 7%. If it rains today, what is the chance that it will not rain three days from now?

- A. 83%
- B. 88%
- C. 90%
- D. 91%

Use the following spreadsheet to answer question 8.

	A	B	C	D
1	8	9	7	
2	5	8	4	
3	3	10	8	
4	2	13	7	
5				

8. If the formula “5\*AVERAGE (B1 . . B4)” was entered into cell D2, what would be the contents of cell D2?

- A. 10
- B. 50
- C. 55
- D. 200

9. Given the spreadsheet with formulas as shown below, what value would be calculated for cell C3?

	A	B	C	D
1	2	5	4	8
2	1	2	0	6
3	8	=A3+C1	=B3^B2	
4				
5				

- A. 24
- B. 64
- C. 144
- D. 400

10. What is the effective (equivalent) annual rate of interest on a car loan advertised with an annual interest rate of 8% compounded monthly?

- A. 8.00%
- B. 8.16%
- C. 8.24%
- D. 8.30%



11. The spreadsheet below shows the beginning of an amortization schedule for a principle of \$40 000 over 60 months with an annual interest rate of 6% compounded monthly.

	<b>A</b>	<b>B</b>	<b>C</b>	<b>D</b>	<b>E</b>	<b>F</b>
<b>1</b>	Payment	Bal. Before	Payment	Interest	Payment	Outstanding
<b>2</b>	#	Payment \$	\$	Payment \$	to Princ. \$	Princ. Bal. \$
<b>3</b>	0					40000.00
<b>4</b>	1	40000.00	773.31			
<b>5</b>	2					
<b>6</b>	3					

What amount should appear in cell D4?

- A. \$200.00
  - B. \$400.00
  - C. \$573.31
  - D. \$773.31
12. Jason purchased a used car with list price \$1 500. He paid \$500 down and amortized the remainder with four equal quarterly payments. Part of the amortization schedule for this debt is shown below.

	<b>A</b>	<b>B</b>	<b>C</b>	<b>D</b>
<b>1</b>	Payment	Payment	Interest	Outstanding
<b>2</b>	#	\$	Payment \$	Balance \$
<b>3</b>	0			1000.00
<b>4</b>	1		25.00	759.18
<b>5</b>	2			
<b>6</b>	3			
<b>7</b>	4			
<b>8</b>				

Determine the total amount Jason paid for the car.

- A. \$1 563.28
- B. \$1 586.08
- C. \$1 600.00
- D. \$1 603.81

13. The spreadsheet below was designed for an auto repair shop.

	A	B	C	D	E	F
1	Quantity	Auto Parts	Unit Price	Total Price	Labour	Labour Cost
2	4	Brake pads	26.34		Overhaul front brakes	
3	2	Wheel seals	5.25		1.5 h @ \$57.00/h	
4	2	Rotors	50.16		Replace rotors	
5						
6						
7						
8						
9					Total labour	
10		Total parts			Total parts	
11					PST (7%)	
12					GST(7%)	
13					Total	
14						

A formula that could be used to do the calculation for the amount in cell D10 is

- A. = SUM(C2 ... C9)
- B. = SUM(D2 ... D9)
- C. = SUM(A2 ... A9)\*SUM(C2 ... C9)
- D. = AVG(A2 ... A9)\*AVG(C2 ... C9)

14. Which description best defines the sequence  $-1, -2, -4, -8, -16, -32, \dots$  ?

- A. static
- B. divergent
- C. alternating
- D. convergent

15. An infinite sequence of numbers is created by the following process:

$$t_1 = 16$$

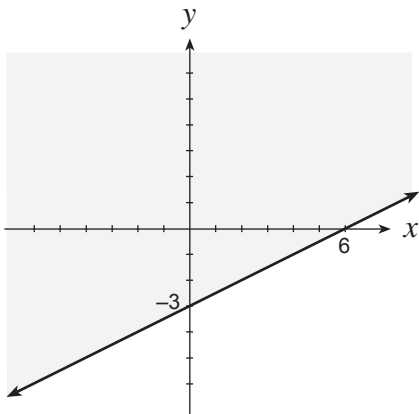
$$t_n = \frac{1}{4} t_{n-1}, \quad n > 1$$

If the process is continued forever, what is the sum of the infinite sequence?

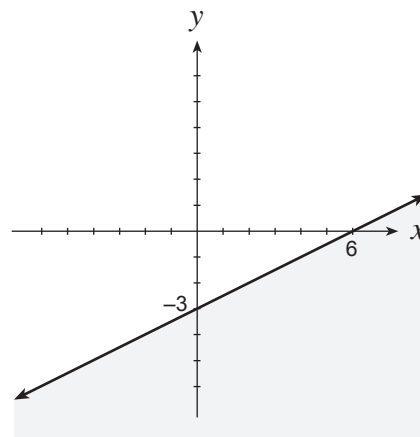
- A.  $\frac{16}{5}$
- B.  $\frac{16}{3}$
- C.  $\frac{64}{5}$
- D.  $\frac{64}{3}$

16. Which of the following represents the graph of  $y \geq \frac{1}{2}x - 3$  ?

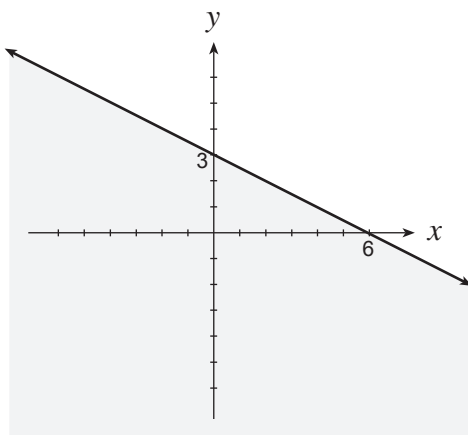
A.



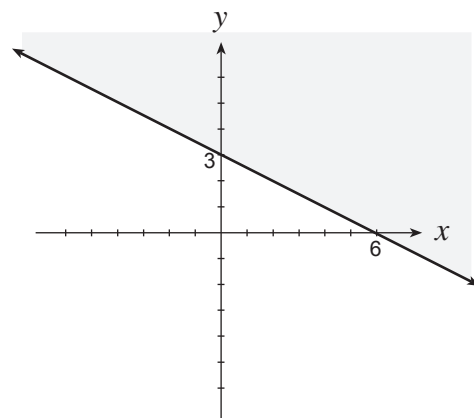
B.



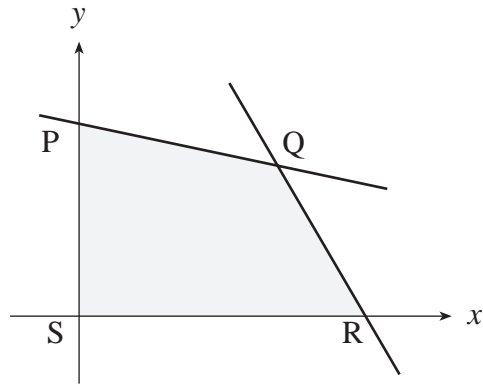
C.



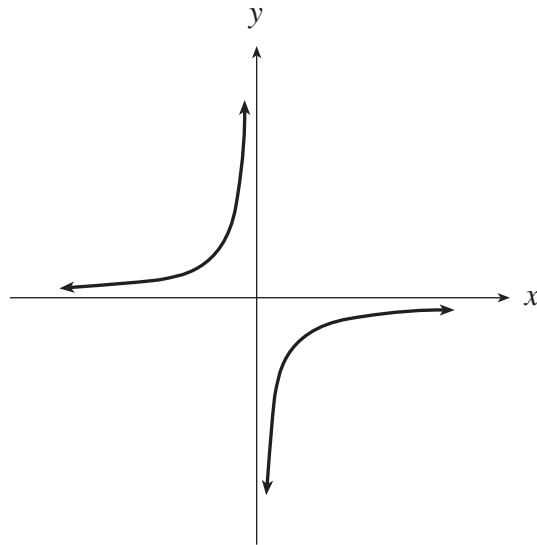
D.



17. A linear programming problem requires that the value of  $N$  is maximized, where  $N = 3x + 5$ . Which of the indicated vertices of the feasible region below maximizes  $N$ ?



- A. P
  - B. Q
  - C. R
  - D. S
18. Which term **best** describes the kind of function graphed below?



- A. power function
- B. reciprocal function
- C. logarithmic function
- D. exponential function

19. Determine the zeros ( $x$ -intercepts) of the function  $f(x) = \frac{1}{10}(2x^3 - 3x^2 - 2x + 3)$ .
- A. 0.3
  - B. -1, 1.5
  - C. -1, 1
  - D. -1, 1, 1.5

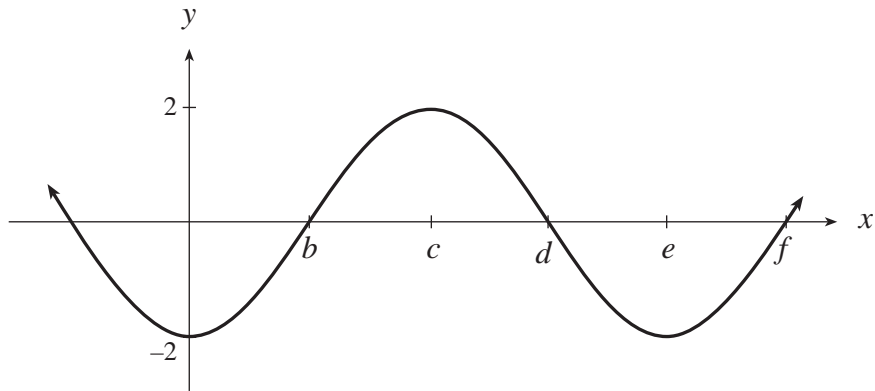
20. Given the following data table:

Time ( $s$ ) $x$	Displacement ( $m$ ) $y$
1.2	3.74
2.1	10.05
2.7	19.42
3.1	30.14

If the data is modelled by an exponential function, what will the displacement be at 2.4 seconds?

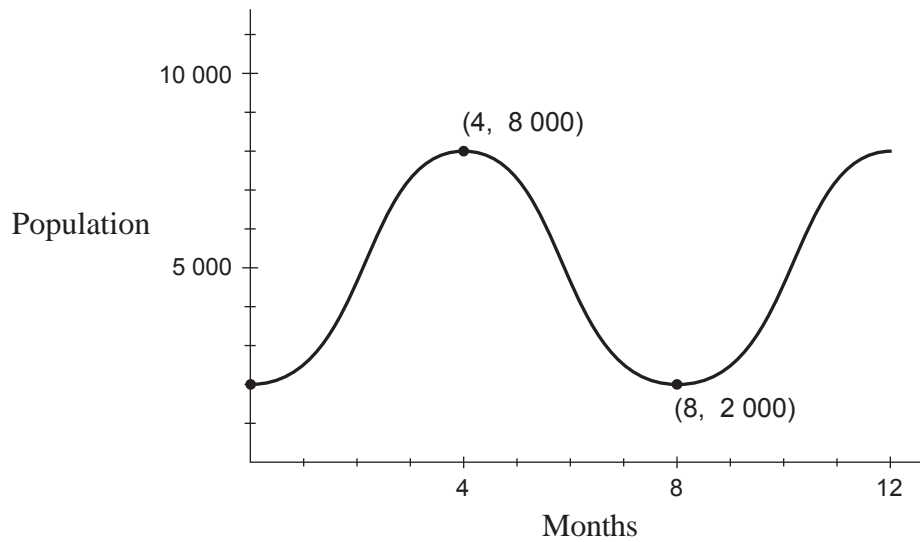
- A. 13.97
  - B. 14.74
  - C. 15.53
  - D. 17.51
21. Determine the period of the function  $y = 2 \sin(3\pi x)$ .
- A.  $\frac{2}{3}$
  - B.  $\frac{3}{2}$
  - C.  $\frac{2\pi}{3}$
  - D.  $3\pi$

22. What is a possible equation for the cosine function graphed below?



- A.  $y = 2 \cos\left(\frac{2\pi}{e} x\right)$
- B.  $y = -2 \cos\left(\frac{2\pi}{e} x\right)$
- C.  $y = 2 \cos\left(\frac{2\pi}{f} x\right)$
- D.  $y = -2 \cos\left(\frac{2\pi}{f} x\right)$

Use the following graph to answer questions 23 and 24.



The graph shows the population over time for a certain colony of beetles in a test region. The curve appears to be sinusoidal.

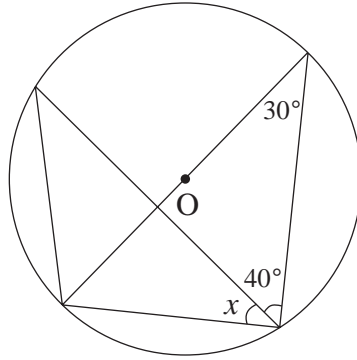
23. Determine the amplitude of the graph.

- A. 3 000
- B. 4 000
- C. 6 000
- D. 8 000

24. What would be the expected population at 37 months? (To the nearest 100 beetles.)

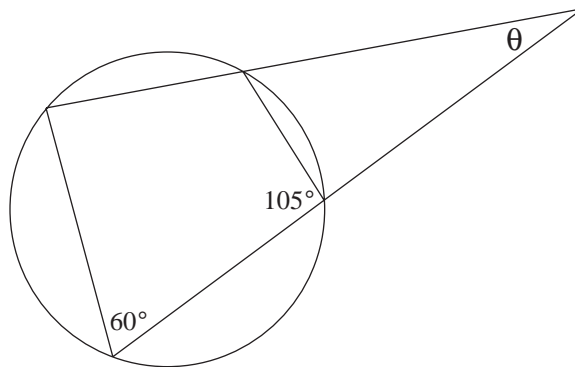
- A. 2 900
- B. 3 000
- C. 7 000
- D. 7 100

25. In the diagram below,  $O$  is the centre of the circle. Determine the measure of angle  $x$ , in degrees.



- A.  $30^\circ$
- B.  $40^\circ$
- C.  $50^\circ$
- D.  $60^\circ$

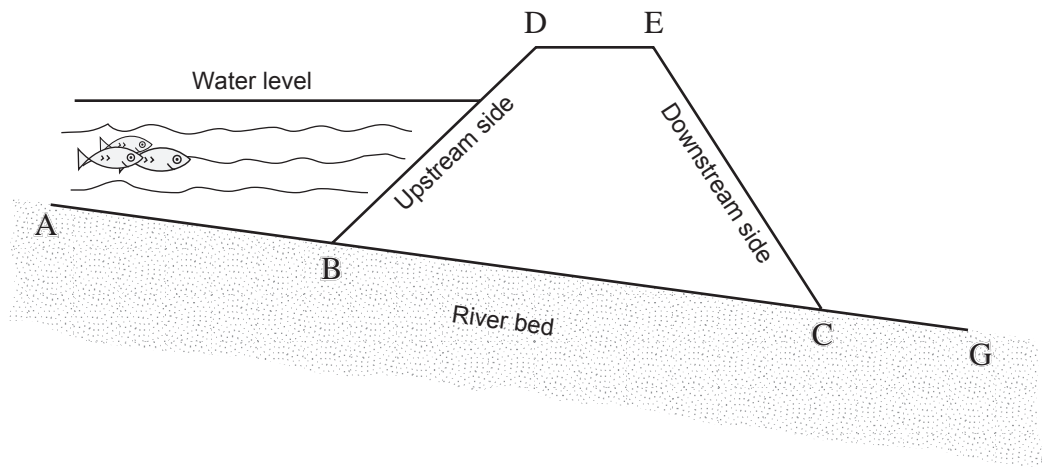
26. Find the measure of angle  $\theta$  in the diagram below.



- A.  $30^\circ$
- B.  $40^\circ$
- C.  $45^\circ$
- D.  $60^\circ$



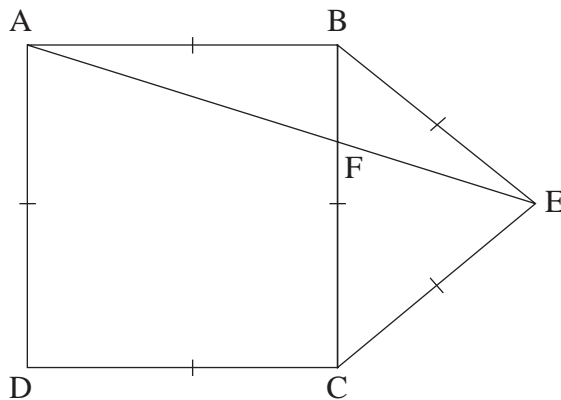
27. The diagram below shows a cross-sectional view of an earth-filled dam.



If  $\angle ABD = 125^\circ$ ,  $\angle BDE = 140^\circ$  and  $\angle DEC = 120^\circ$ , determine the measure of  $\angle ECG$ .

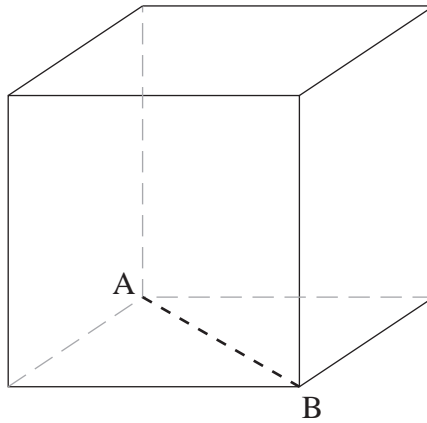
- A.  $120^\circ$
- B.  $125^\circ$
- C.  $135^\circ$
- D.  $140^\circ$

28. In the diagram below,  $ABCD$  is a square and  $\triangle BCE$  is equilateral. Find the measure of  $\angle AFC$ .

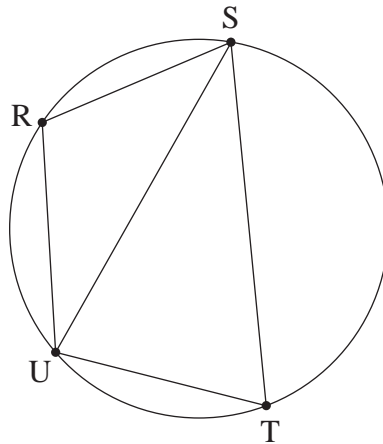


- A.  $75^\circ$
- B.  $100^\circ$
- C.  $105^\circ$
- D.  $120^\circ$

29. A cube has a total surface area of  $120 \text{ cm}^2$ . What is the length of the diagonal AB of the cube?



- A. 5.48 cm  
B. 6.32 cm  
C. 6.97 cm  
D. 7.75 cm
30. In the diagram below, R, S, T, U are points on the circle with  $RS = RU = UT$  and  $SU = ST$ . Find the measure of  $\angle UST$ .

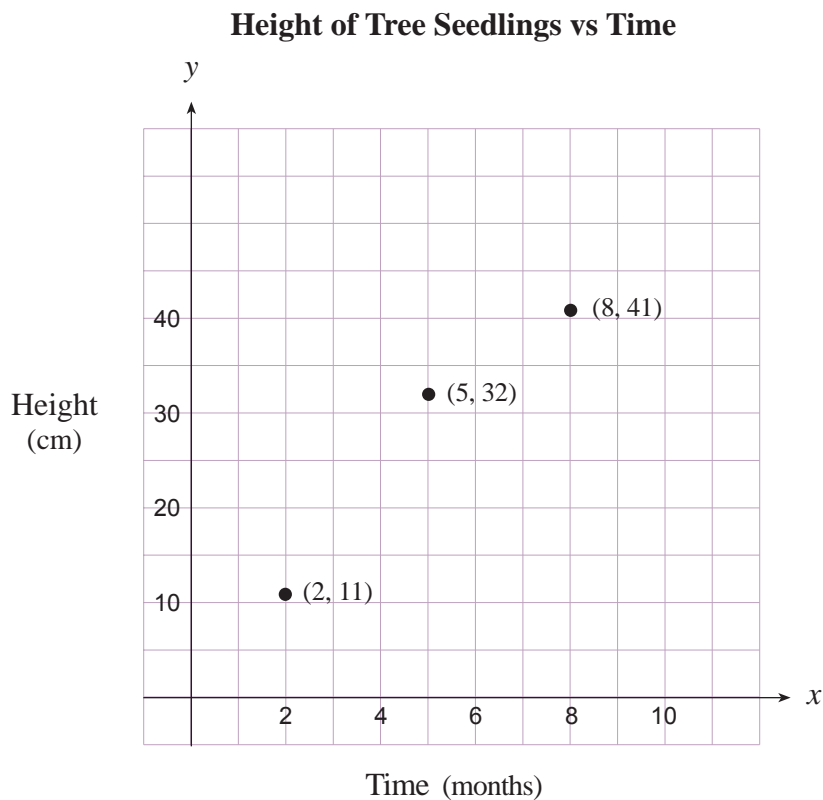


- A.  $31^\circ$   
B.  $35^\circ$   
C.  $36^\circ$   
D.  $40^\circ$

31. A sphere is inscribed in the smallest right circular cylinder that can contain it. What is the ratio of the volume of the sphere to the volume of the cylinder?
- A. 2:3  
 B. 3:2  
 C. 3:4  
 D. 4:3

32. Which of the following is an example of discrete data?
- A. The number of litres of pop in a truckload.  
 B. The number of bottles of pop in a truckload.  
 C. The number of kilograms of pop in a truckload.  
 D. The number of kilometres the truck has travelled.

33. The graph below shows the three summary points used to find the equation of the median-median line for a data set collected in a reforestation project.



Find the equation of this median-median line.

- A.  $y = 5x + 1$   
 B.  $y = 5x + 3$   
 C.  $y = 5x + 5$   
 D.  $y = 5x + 7$

**OVER**

34. A set of data  $(x, y)$  is outlined below. What value of  $k$  would yield a linear correlation coefficient  $r = -1$  ?

$x$	$y$
2	9
8	7
$k$	3

- A. -29  
B. 12  
C. 14  
D. 20
35. Which of the following numbers cannot represent the probability of an event occurring?
- A.  $-\frac{1}{2}$   
B. 0  
C.  $\frac{1}{2}$   
D. 1
36. For a certain casino game the probability of winning is  $\frac{12}{25}$ . The game is played 60 times and this situation is modelled with a binomial random variable. Determine the standard deviation for the number of wins.
- A. 3.87  
B. 5.36  
C. 14.48  
D. 28.80

37. In the Chilliwack river, records show that for any day in January, the probability that a fish caught will be a trout is  $\frac{1}{5}$  and the probability that it will be a steelhead is  $\frac{1}{10}$ . What is the probability that a fish caught will be either a trout or a steelhead?
- A.  $\frac{1}{50}$   
 B.  $\frac{2}{15}$   
 C.  $\frac{7}{25}$   
 D.  $\frac{3}{10}$
38. Twelve cards each have one letter of the word APPLICATIONS on them. If a card is drawn, what is the probability that it will show the letter I or the letter P ?
- A.  $\frac{1}{3}$   
 B.  $\frac{1}{4}$   
 C.  $\frac{1}{6}$   
 D.  $\frac{1}{36}$

39. The table below gives the heights of 100 students in a secondary school.

Height (cm)	Number of Students
$150 \leq h < 160$	6
$160 \leq h < 170$	12
$170 \leq h < 180$	34
$180 \leq h < 190$	41
$190 \leq h < 200$	7

Determine the mean height of this group, to the nearest cm.

- A. 175  
 B. 176  
 C. 177  
 D. 178

**OVER**

40. A 15 member school basketball team holds occasional draws for tickets to the Grizzlies. Three different players have already won tickets in previous draws. If two names are selected at random from the team roster, what is the probability that both selected are not previous winners?

- A.  $\frac{16}{25}$
- B.  $\frac{22}{35}$
- C.  $\frac{34}{35}$
- D.  $\frac{44}{75}$

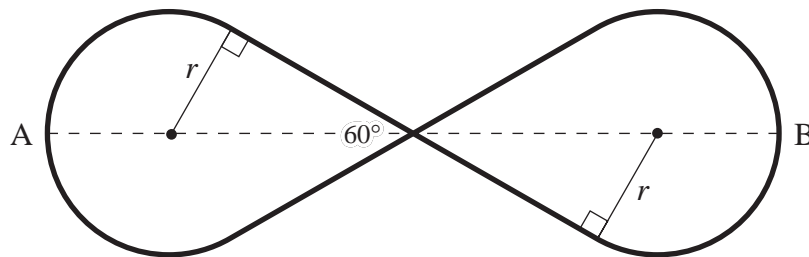
41. A batter averages 3 hits for every 10 times at bat. What is the probability that she will get exactly 3 hits in her next 8 times at bat?

- A. 0.1125
- B. 0.2400
- C. 0.2541
- D. 0.3375

42. Determine the number of 7-digit palindromic phone numbers that can be created if the only restriction is that 0 cannot appear as the first or third digit.

- A. 810
- B. 8 100
- C. 9 000
- D. 8 100 000

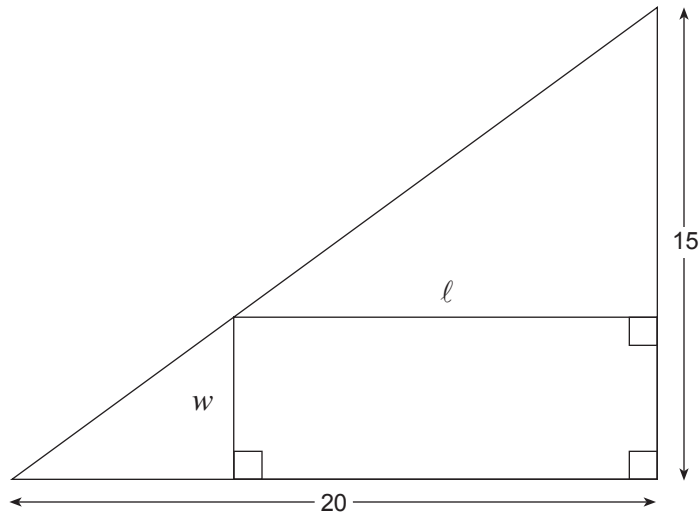
43. A figure-8 race track measures 180 cm across at its longest section, AB. What is the radius,  $r$ , of the figure-8 track if the tracks intersect at  $60^\circ$  ?



- A. 22.5
- B. 30
- C. 36
- D. 45

44. Sally sails from her island home by sailing 2 km north, 4 km east, 6 km south, 8 km west, 10 km north, and continues in this same way, increasing the number of km by 2 every time she turns right. How many km is Sally from home when she starts her 2<sup>nd</sup> turn east?
- A. 10  
 B.  $\sqrt{30}$   
 C.  $\sqrt{42}$   
 D.  $\sqrt{52}$

Use the following diagram to answer question 45.



45. Which of the following is an equation that describes the relationship between  $l$  and  $w$  ?
- A.  $3l + 4w = 60$   
 B.  $4l + 3w = 60$   
 C.  $3l - 4w = 60$   
 D.  $4l - 3w = 60$

**This is the end of the multiple-choice section.  
 Answer the remaining questions directly in this examination booklet.**

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## PART B: WRITTEN RESPONSE

Value: 25 marks

Suggested Time: 45 minutes

**INSTRUCTIONS:** Rough-work space has been incorporated into the space allowed for answering each question. You may not need all the space provided to answer each question. Where required, place the final answer for each question in the space provided.

If, in a justification, you refer to information produced by the calculator, this information must be presented clearly in the response. For example, if a graph is used in the solution of the problem, it is important to sketch the graph, showing its general shape and indicating the appropriate window dimensions.

When using the calculator, you should provide a decimal answer that is correct to **at least two decimal places** (unless otherwise indicated). Such rounding should occur **only** in the final step of the solution.

**Full marks will NOT be given for the final answer only.**

1. A fast-food restaurant chain collects the following data to determine how the number of restaurants within a 1.5 km radius affects the daily sales.

Number of restaurants in 1.5 km radius	Daily sales (\$)
1	3 600
2	3 100
3	2 700
4	2 500
5	2 300

- a) If  $x$  represents the number of restaurants and  $y$  the daily sales, determine the equation of the least squares line of best fit. **(2 marks)**

ANSWER:

b) Predict the daily sales if there are nine restaurants in the 1.5 km radius.

**(1 mark)**

ANSWER:

**OVER**

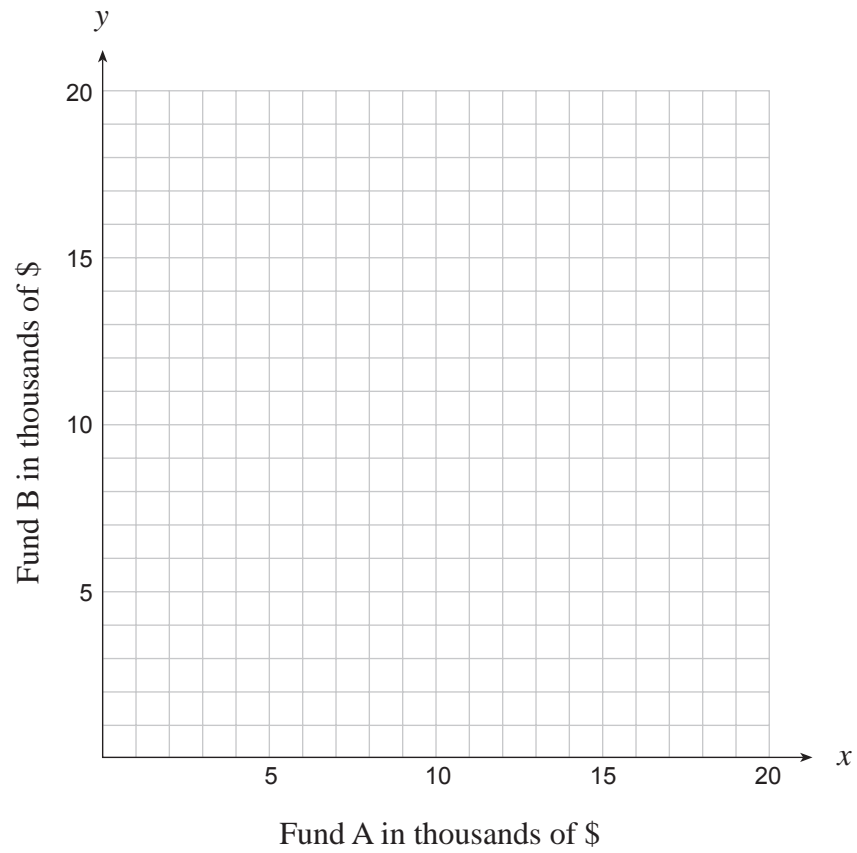
2. A man can invest at most \$18 000 in two different mutual funds, A and B. Mutual fund A returns 8% annually, and mutual fund B returns 12% annually, but at a higher risk than A. To be safe, he wants to invest at least three times as much in fund A as in fund B. Let  $x$  represent the amount in fund A and  $y$  the amount in fund B.

a) Write the constraints and the objective function that would be used to determine the maximum return on his investment. **(2 marks)**

ANSWER:

b) Graph the feasible region obtained by these constraints.

(1 mark)



c) Determine the maximum return on his investment given these constraints.

(1 mark)

ANSWER:

3. A new light rapid transit system has just started. Each month, 90% of the commuters who use light rapid transit will continue to do so, while 20% of those who travel by car will switch to light rapid transit. At present, 15% of all commuters use light-rapid transit, while the rest use cars.

a) After two months, what percent of commuters will be using cars?

**(2 marks)**

ANSWER:

- b) If the pattern continues, what percent of commuters will be using light rapid transit in the long run? **(1 mark)**

ANSWER:

**OVER**

4. A company that makes chocolate bars sells one type whose mass is supposed to be 100 g. The company knows that the masses of their bars follow a normal distribution with a mean of 105 g and a standard deviation of 2.5 g. If they make 40 000 of these bars a day, how many have mass less than 100 g ? **(3 marks)**



ANSWER:

**OVER**

5. A learning curve describes the rate at which a skill can be learned. Assume the equation

$$n = -153 \log\left(1 - \frac{w}{90}\right)$$

describes the number of practice sessions,  $n$ , it will take to reach a skill level of  $w$  words per minute on a computer keyboard.

- a) Determine how many sessions will be needed to reach a level of 60 words per minute.

**(1 mark)**

ANSWER:

b) Determine the skill level in words per minute after 80 sessions.

(2 marks)

If providing a graphical solution, state the function(s) used, sketch the graph, indicate appropriate window dimensions and clearly explain how your solution is derived from the graph.



$Y_1 =$

$Y_2 =$

$Y_3 =$

$Y_4 =$

[            ,            ]            [            ,            ]

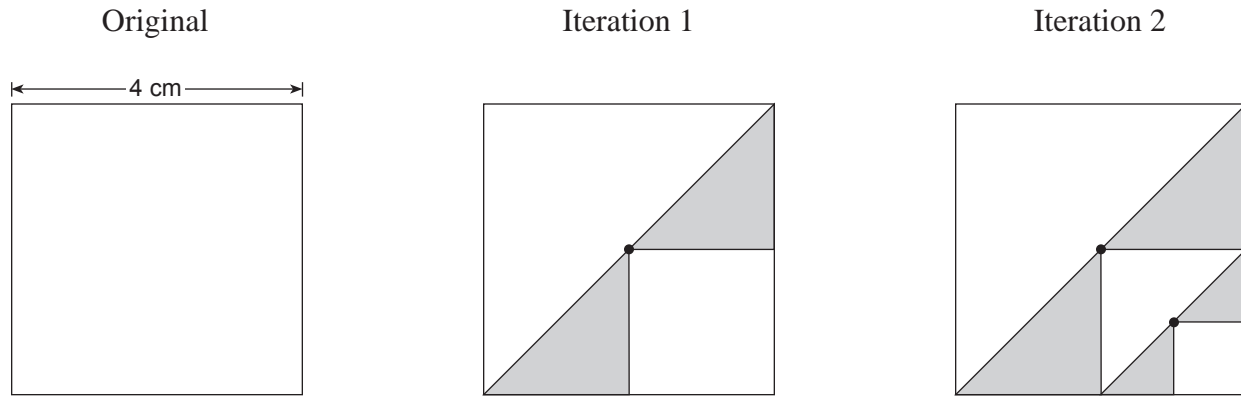
$x$              $x$   
min            max

$y$              $y$   
min            max

ANSWER:

6. A fractal is created as follows:

A square is drawn with sides 4 cm. A diagonal is constructed and a new square is created below the diagonal using the midpoint of the diagonal as one corner. The two small triangles formed below the diagonal are shaded. This process is continued with the smaller square.



a) If this process is continued, what is the total area of the **shaded** region of the 4<sup>th</sup> iteration?  
(2 marks)

ANSWER:

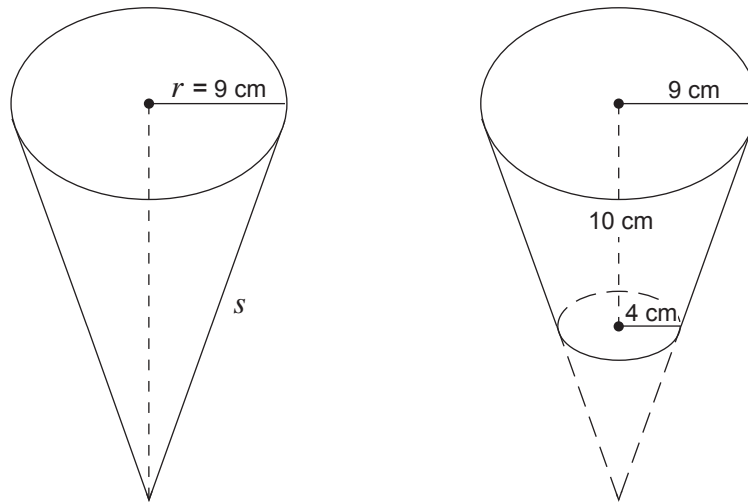
b) If this process continues without end, determine the area of the shaded region. **(1 mark)**

ANSWER:

**OVER**

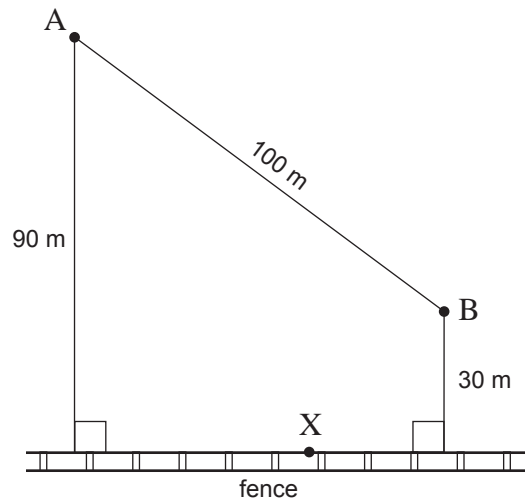
7. A funnel is made from a right circular cone by cutting a small cone from the tip of the larger cone, as shown in the diagram below. Determine the slant height  $s$  of the original cone.

**(3 marks)**



ANSWER:

8. In running a race, participants must start at point A, run to a point X on the fence, and then finish at point B. If the total distance to be run is a minimum, how far is it from A to X ?  
(3 marks)





ANSWER:

**END OF EXAMINATION**

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## FORMULAE

### Geometry:

Triangle:      Area =  $\frac{1}{2}bh$   
                      =  $\frac{1}{2}ab \sin C$   
                      =  $\frac{1}{2} \frac{a^2 \sin B \sin C}{\sin A}$   
                      =  $\sqrt{s(s-a)(s-b)(s-c)}$   
                      where  $s = \frac{a+b+c}{2}$

Circle:             $A = \pi r^2$ ,  $C = 2\pi r = \pi d$

Sphere:            $A = 4\pi r^2$ ,  $V = \frac{4}{3}\pi r^3$

Cylinder:         $A = 2\pi r^2 + 2\pi rh$ ,  $V = \pi r^2 h$

Cone:              $A = \pi rs + \pi r^2$ ,  $V = \frac{1}{3}\pi r^2 h$

Volume of pyramid:  $V = \frac{1}{3}A_b h$

Volume of prism:  $V = A_b h$

### Interest:

$$A = P\left(1 + \frac{r}{n}\right)^{nt}$$

$$I = Prt$$

### Miscellaneous:

$$a^2 = b^2 + c^2 - 2bc \cos A$$

$$\frac{\sin A}{a} = \frac{\sin B}{b} = \frac{\sin C}{c}$$

$$d = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$$

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

$$S_\infty = \frac{a}{1-r}$$

### Probability and Statistics:

$${}_n P_r = P(n, r) = \frac{n!}{(n-r)!}$$

$${}_n C_r = C(n, r) = \binom{n}{r} = \frac{n!}{r!(n-r)!}$$

$$\bar{x} = \frac{1}{n} \sum (f_i)(x_i)$$

$$\sigma = \sqrt{\frac{1}{n} \sum (x_i - \bar{x})^2} = \sqrt{\frac{1}{n} \sum x_i^2 - \bar{x}^2}$$

$$\mu = np$$

$$\sigma = \sqrt{npq}$$

$$b(n, r; p) = \binom{n}{r} p^r q^{n-r}$$

$$z = \frac{x - \bar{x}}{\sigma}$$

$$\bar{x} - z_{\alpha/2} \frac{\sigma}{\sqrt{n}} < \mu < \bar{x} + z_{\alpha/2} \frac{\sigma}{\sqrt{n}}$$

$$E(x) = x_1 p_1 + x_2 p_2 + \dots + x_n p_n$$

$$P(A \cup B) = P(A) + P(B) - P(A \cap B)$$

$$r = \frac{n \sum xy - (\sum x)(\sum y)}{\left(\sqrt{n(\sum x^2) - (\sum x)^2}\right) \left(\sqrt{n(\sum y^2) - (\sum y)^2}\right)}$$

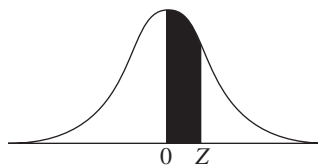
**Note:** Graphing calculators will contain many of these formulae as pre-programmed functions.

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# TABLE OF Z-SCORES

## Z = Z-Score

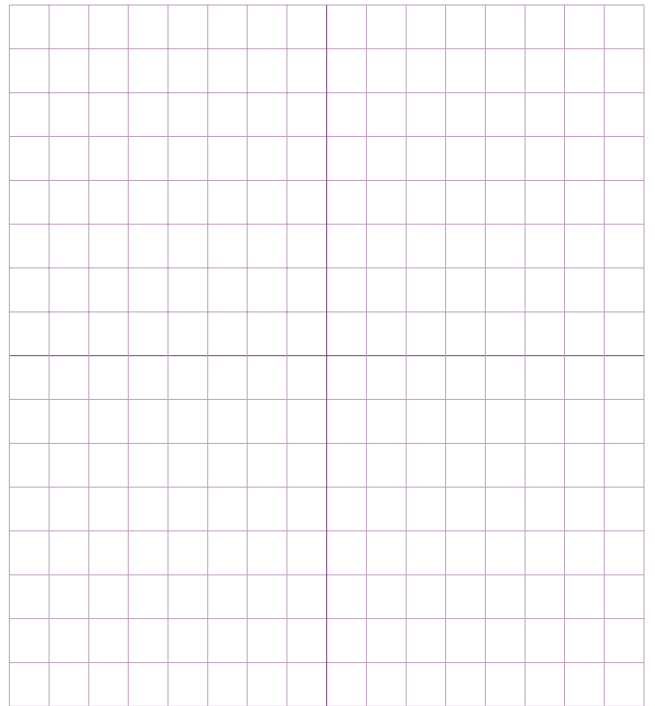
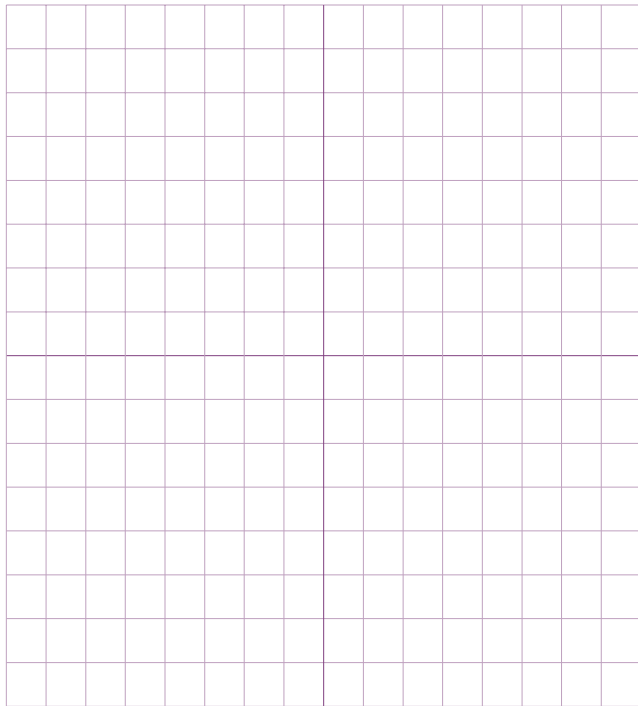
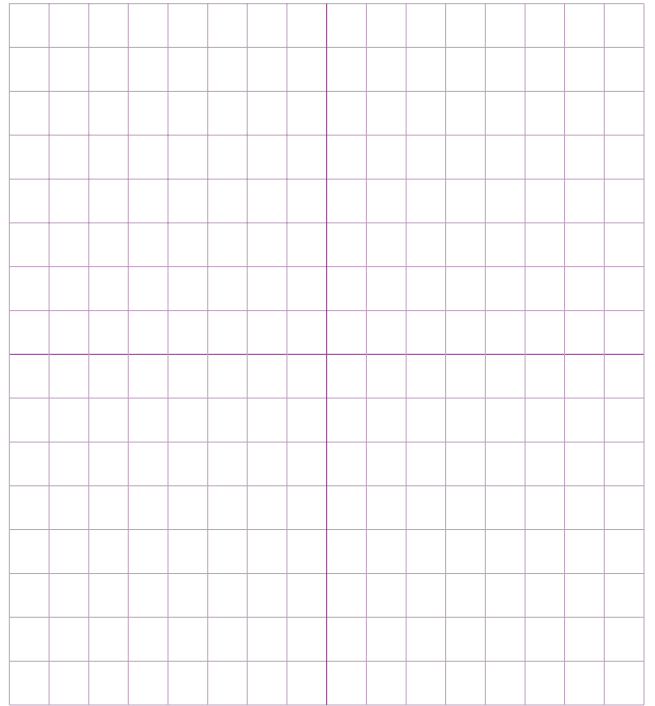
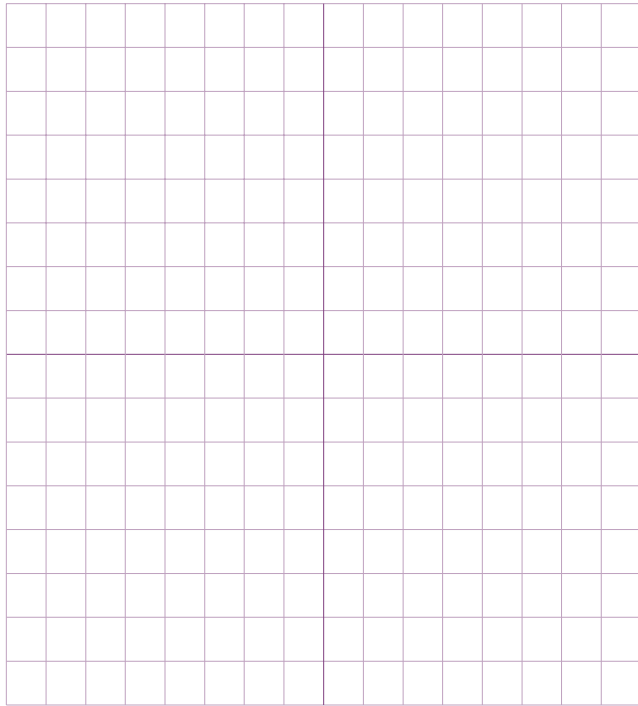
An entry in the table is the area under the curve between  $Z = 0$  and a positive value of  $Z$ . Areas for negative values of  $Z$  are obtained by symmetry.



Z	0.00	0.01	0.02	0.03	0.04	0.05	0.06	0.07	0.08	0.09
0.0	0.0000	0.0040	0.0080	0.0120	0.0160	0.0199	0.0239	0.0279	0.0319	0.0359
0.1	0.0398	0.0438	0.0478	0.0517	0.0557	0.0596	0.0636	0.0675	0.0714	0.0753
0.2	0.0793	0.0832	0.0871	0.0910	0.0948	0.0987	0.1026	0.1064	0.1103	0.1141
0.3	0.1179	0.1217	0.1255	0.1293	0.1331	0.1368	0.1406	0.1433	0.1480	0.1517
0.4	0.1554	0.1591	0.1628	0.1664	0.1700	0.1736	0.1772	0.1808	0.1844	0.1879
0.5	0.1915	0.1950	0.1985	0.2019	0.2054	0.2088	0.2123	0.2157	0.2190	0.2224
0.6	0.2257	0.2291	0.2324	0.2357	0.2389	0.2422	0.2454	0.2486	0.2517	0.2549
0.7	0.2580	0.2611	0.2642	0.2673	0.2703	0.2734	0.2764	0.2794	0.2823	0.2852
0.8	0.2881	0.2910	0.2939	0.2967	0.2995	0.3023	0.3051	0.3078	0.3106	0.3133
0.9	0.3159	0.3186	0.3212	0.3238	0.3264	0.3289	0.3315	0.3340	0.3365	0.3389
1.0	0.3413	0.3438	0.3461	0.3485	0.3508	0.3531	0.3554	0.3577	0.3599	0.3621
1.1	0.3642	0.3665	0.3686	0.3708	0.3729	0.3749	0.3770	0.3790	0.3810	0.3830
1.2	0.3849	0.3869	0.3888	0.3907	0.3925	0.3944	0.3962	0.3980	0.3997	0.4015
1.3	0.4032	0.4049	0.4066	0.4082	0.4099	0.4115	0.4131	0.4147	0.4162	0.4177
1.4	0.4192	0.4207	0.4222	0.4236	0.4251	0.4265	0.4279	0.4292	0.4306	0.4319
1.5	0.4332	0.4345	0.4357	0.4370	0.4382	0.4394	0.4406	0.4418	0.4429	0.4441
1.6	0.4452	0.4463	0.4474	0.4484	0.4495	0.4505	0.4515	0.4525	0.4535	0.4545
1.7	0.4554	0.4564	0.4573	0.4582	0.4591	0.4599	0.4608	0.4616	0.4625	0.4633
1.8	0.4641	0.4649	0.4656	0.4664	0.4671	0.4678	0.4686	0.4693	0.4699	0.4706
1.9	0.4713	0.4719	0.4726	0.4732	0.4738	0.4744	0.4750	0.4756	0.4761	0.4767
2.0	0.4772	0.4778	0.4783	0.4788	0.4793	0.4798	0.4803	0.4808	0.4812	0.4817
2.1	0.4821	0.4826	0.4830	0.4834	0.4838	0.4842	0.4846	0.4850	0.4854	0.4857
2.2	0.4861	0.4864	0.4868	0.4871	0.4875	0.4878	0.4881	0.4884	0.4887	0.4890
2.3	0.4893	0.4896	0.4898	0.4901	0.4904	0.4906	0.4909	0.4911	0.4913	0.4916
2.4	0.4918	0.4920	0.4922	0.4925	0.4927	0.4929	0.4931	0.4932	0.4934	0.4936
2.5	0.4938	0.4940	0.4941	0.4943	0.4945	0.4946	0.4948	0.4949	0.4951	0.4952
2.6	0.4953	0.4955	0.4956	0.4957	0.4959	0.4960	0.4961	0.4962	0.4963	0.4964
2.7	0.4965	0.4966	0.4967	0.4968	0.4969	0.4970	0.4971	0.4972	0.4973	0.4974
2.8	0.4974	0.4975	0.4976	0.4977	0.4977	0.4978	0.4979	0.4979	0.4980	0.4981
2.9	0.4981	0.4982	0.4982	0.4983	0.4984	0.4984	0.4985	0.4985	0.4986	0.4986
3.0	0.4987	0.4987	0.4987	0.4988	0.4988	0.4989	0.4989	0.4989	0.4990	0.4990

**ROUGH WORK FOR GRAPHING**

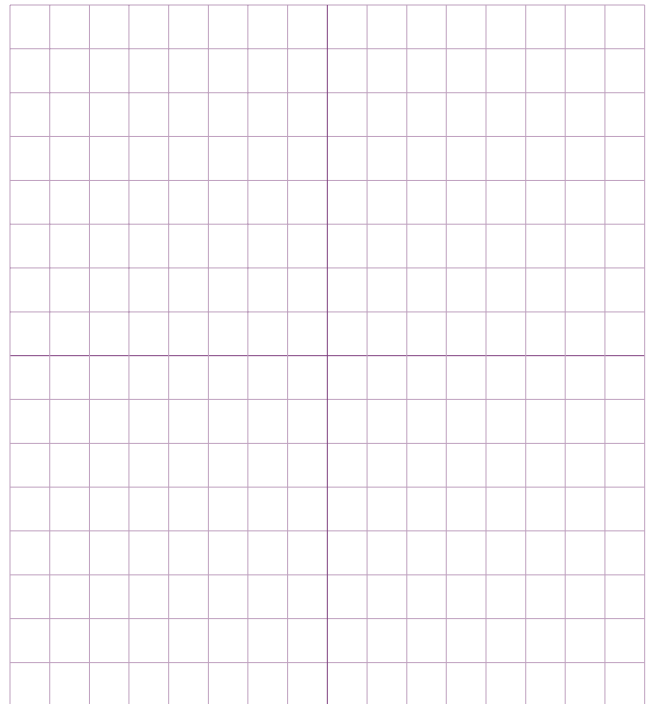
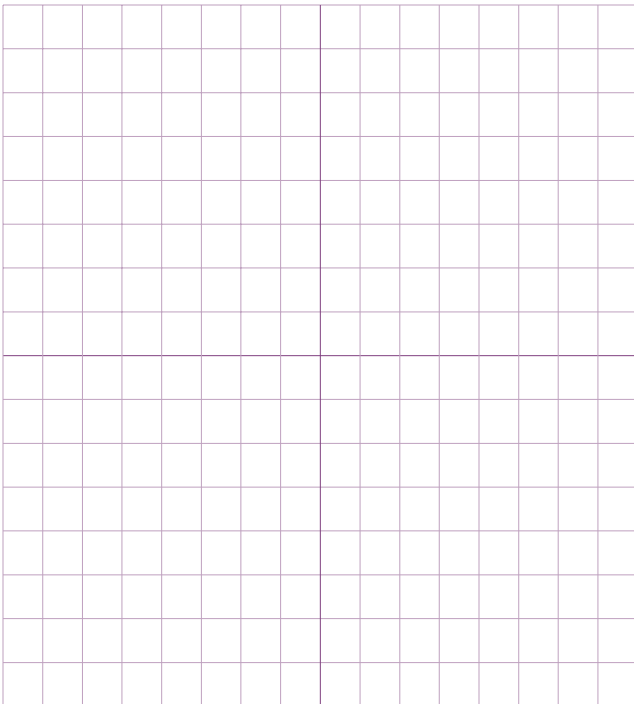
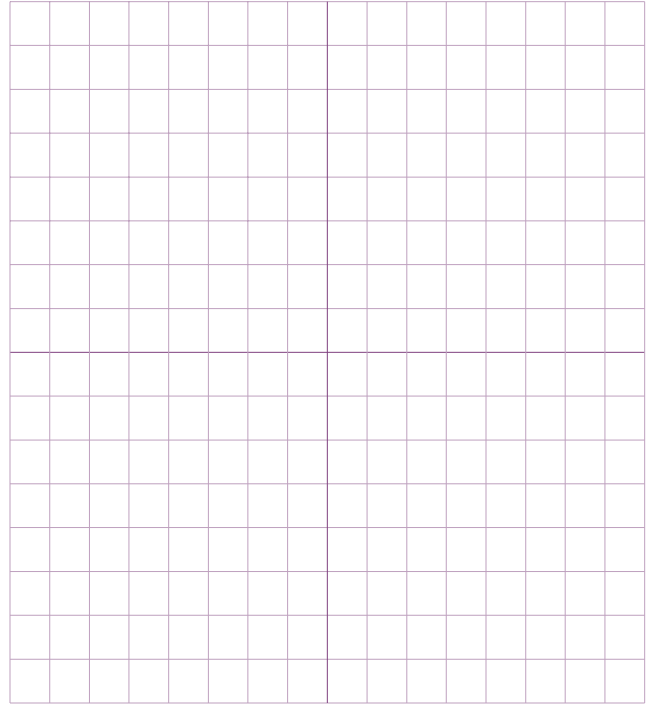
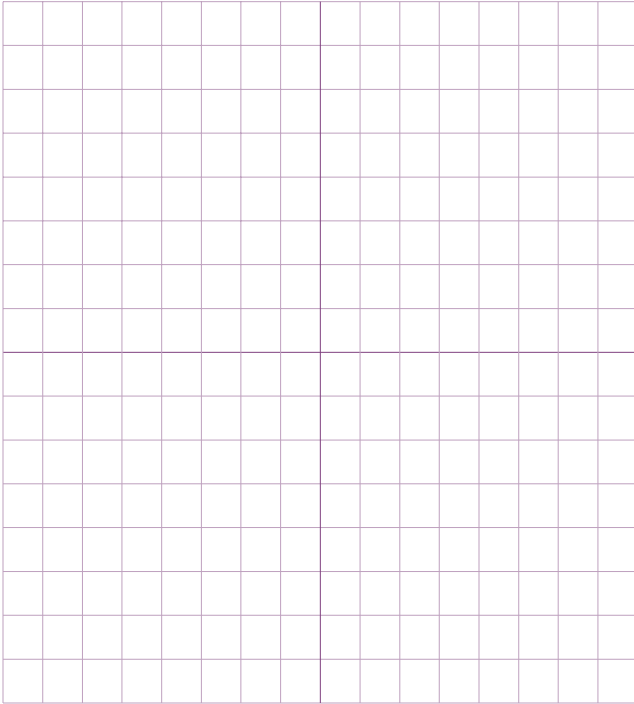
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# ROUGH WORK FOR GRAPHING

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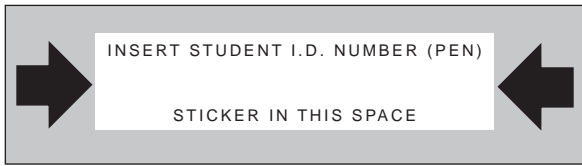
**ROUGH WORK FOR MULTIPLE-CHOICE**

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## ROUGH WORK FOR MULTIPLE-CHOICE







# **APPLICATIONS OF MATHEMATICS 12**

**June 1999**

Course Code = AMA

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**APPLICATIONS OF  
MATHEMATICS 12**

**June 1999**

Course Code = AMA

Score for  
Question 1a:

1.  $\frac{\quad}{(2)}$

Score for  
Question 4:

8.  $\frac{\quad}{(3)}$

Score for  
Question 1b:

2.  $\frac{\quad}{(1)}$

Score for  
Question 5a:

9.  $\frac{\quad}{(1)}$

Score for  
Question 2a:

3.  $\frac{\quad}{(2)}$

Score for  
Question 5b:

10.  $\frac{\quad}{(2)}$

Score for  
Question 2b:

4.  $\frac{\quad}{(1)}$

Score for  
Question 6a:

11.  $\frac{\quad}{(2)}$

Score for  
Question 2c:

5.  $\frac{\quad}{(1)}$

Score for  
Question 6b:

12.  $\frac{\quad}{(1)}$

Score for  
Question 3a:

6.  $\frac{\quad}{(2)}$

Score for  
Question 7:

13.  $\frac{\quad}{(3)}$

Score for  
Question 3b:

7.  $\frac{\quad}{(1)}$

Score for  
Question 8:

14.  $\frac{\quad}{(3)}$